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IoT based Heart Attack and Alcohol Detection using Raspberry Pi

N Kishore Kumar [1] , B Jeevan Kumar [2] , C Manikanta Reddy [3] , B Dinakar [4], N Chandu [5]

[1-5] Department of ECE , JNTU Anantapuramu , Andhra Pradesh , India

** Corresponding Author : N Kishore Kumar ; kishorekumar@gmail.com*

Abstract: This paper explores the development of a comprehensive system designed to enhance vehicle safety by interfacing various sensors and modules with a Raspberry Pi. In our proposed project, the system provides sensors that allow detecting heart rate of a person using heartbeat sensing even if the person is at a remote place (i.e. home, office, travel. Etc). The system incorporates a heart rate sensor to monitor the driver's heartbeat, an alcohol sensor to detect alcohol levels, and an ultrasonic sensor to measure the distance between the driver's vehicle and the vehicle ahead. Visual feedback is provided through an LCD display, while auditory alerts are facilitated by a buzzer. Additionally, the system includes a motor and motor driver to simulate vehicle actions. A GPS module is integrated to obtain latitude and longitude coordinates, enabling location tracking, while a GSM module allows for SMS alerts to be sent in the event of critical situations. By combining these components, the system aims to provide real-time monitoring and alerts to mitigate potential risks associated with impaired driving and maintain road safety standards.

Keywords: Raspberry , IOT, Heartbeat Sensor, Alcohol Sensor, Ultrasonic Sensor, GSM, GPS, Driver Module.

1. Introduction

This project presents the design and implementation of a comprehensive smart transportation system aimed at enhancing vehicle safety by integrating a range of sensors and modules with a Raspberry Pi platform. The system encompasses crucial functionalities such as monitoring the driver's heart rate, detecting alcohol levels, and assessing the proximity between vehicles. These sensor inputs are processed in real-time to provide visual feedback via an LCD display and auditory alerts through a buzzer, ensuring timely intervention in critical situations. Moreover, the inclusion of a GPS module enables location tracking, while a GSM module facilitates the transmission of SMS alerts to designated recipients. By leveraging IoT technology, this system offers a proactive approach to mitigate potential risks associated with impaired driving and unforeseen health emergencies, thereby contributing to the overarching goal of maintaining road safety standards. In Today's world because the population is increasing day-by- day the no of auto-vehicles, conjointly will increase on the road & highways. This accident detection & coverage system issued to avoid wasting the lives by creating the medical facilities in bound on time. In this project we tend to area unit developed a wireless system exploitation MEMS & GPS for accident detection & coverage. The main purpose of this project is to introduce the concept of vehicle safety for application in India. The most purpose of this device is act as Associate in Nursing Emergency device for vehicle drivers who are in Potential whereas accident happens.

This paper describes about to build heart rate monitoring and heart attack detection system using onboard Wi-Fi module. Remote monitoring is seen as an effective method of providing immediate care as it allows for continuous as well as emergency transmission of patient information to the doctor or healthcare provider People who have suffered from chronic diseases are monitored their vital signs continuously. Vital signs include the measurement of temperature, pulse rate, blood pressure and blood oxygen saturation. It provides information about a patient's state of health. The MQ4 sensor recognizes liquor fumes from the drivers breathe, while the Raspberry Pi processes the sensor information and sense orders to the start control module to lock or open it.

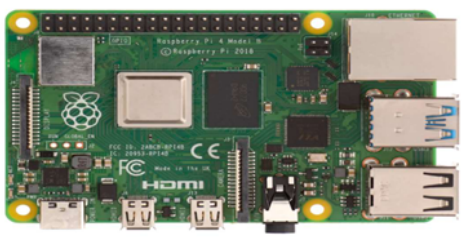

Figure. 1 Raspberry Pi

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2. Literature Survey

Several studies have explored the integration of sensor technologies and IoT systems in the context of smart transportation to enhance road safety. One notable example is the work of Zhang et al. (2019), who proposed a similar system incorporating heart rate monitoring and alcohol detection sensors for driver safety. Their study, titled "IoT-Based Driver Safety Monitoring System Using Wearable Sensors," utilized wearable sensors to continuously monitor the driver's physiological parameters and detect alcohol levels, providing real-time feedback to mitigate risks of accidents due to driver impairment. Another relevant study by Kumar et al. (2020), titled "Development of Smart Vehicle Safety System Using IoT and Raspberry Pi," presented a comprehensive framework that integrated various sensors with a Raspberry Pi platform to monitor driver behavior and vehicle conditions. Their system included features such as alcohol detection, fatigue detection, and collision avoidance, aiming to improve overall road safety.

Additionally, research by Liu et al. (2018) explored the utilization of IoT-enabled smart vehicles for driver assistance and accident prevention. Their paper, "Smart Transportation System Based on IoT: A Survey," provided an overview of IoT applications in transportation systems, highlighting the potential of real-time monitoring and data analytics to enhance road safety. These studies collectively underscore the significance of integrating sensor technologies and IoT platforms in developing proactive systems for driver safety and accident prevention in smart transportation environments.

Despite numerous efforts to improve road safety, accidents caused by factors such as impaired driving due to alcohol consumption or unforeseen health emergencies like heart attacks continue to pose significant risks to motorists and pedestrians alike. Traditional methods of ensuring road safety, such as legal enforcement and public awareness campaigns, have limitations in effectively addressing these issues in real-time. There exists a need for proactive systems that can actively monitor drivers' conditions and provide timely interventions to mitigate potential risks on the road. Current technologies lack integration and real time monitoring capabilities, hindering their ability to effectively prevent accidents caused by impaired driving or health emergencies. Therefore, there is a pressing need to develop a comprehensive smart transportation system that leverages Internet of Things (IoT) technology to monitor drivers' physiological parameters, detect alcohol levels, and assess driving conditions in real-time, ultimately aiming to enhance road safety and reduce the incidence of accidents caused by impaired driving or health emergencies.

The primary objective of this project is to develop a comprehensive smart transportation system using Internet of Things (IoT) technology to enhance road safety. The specific goals include: Integration of various sensors, including a heart rate sensor and an alcohol detection sensor, with a Raspberry Pi platform to monitor driver's physiological parameters and detect potential impairments such as alcohol intoxication or health emergencies like heart attacks. Real-time processing of sensor data to provide visual feedback through an LCD display and auditory alerts via a buzzer to alert the driver and mitigate risks in critical situations.

Incorporation of an ultrasonic sensor to measure the distance between the driver's vehicle and the vehicle ahead, facilitating collision avoidance and ensuring safe driving practices. Implementation of additional functionalities such as location tracking using a GPS module and SMS alerts through a GSM module to enable timely intervention and assistance in emergency situations.

Evaluation of the system's performance in simulated and real world driving scenarios to assess its effectiveness in enhancing road safety and preventing accidents caused by impaired driving or unforeseen health emergencies. By achieving these objectives, the project aims to contribute towards the development of proactive systems that can actively monitor and mitigate risks associated with impaired driving and health emergencies, ultimately enhancing overall road safety standards.

3. Proposed Method

To address these limitations, a proposed method integrates multiple sensors and modules with a Raspberry Pi to create a holistic vehicle safety system. The system includes a heart rate sensor to continuously monitor the driver's heartbeat, enabling early detection of stress or fatigue. An alcohol sensor is incorporated to measure alcohol levels, with monitoring capabilities to promptly alert the driver if impairment is detected. Additionally, an ultrasonic sensor is employed to measure the distance between the driver's vehicle and the vehicle ahead, providing timely warnings to prevent collisions.

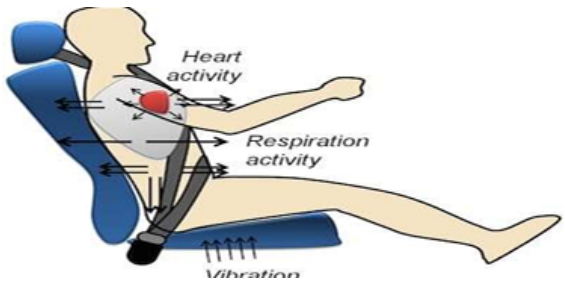

Figure.2 Heartbeat Sensor in seat belt

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Visual feedback is provided through an LCD display, while auditory alerts are facilitated by a buzzer, enhancing the driver's situational awareness. Furthermore, a motor and motor driver simulate vehicle actions, enabling the system to respond dynamically to detected hazards. Integration with a GPS module enables location tracking, while a GSM module allows for SMS alerts to be sent to emergency contacts or authorities in case of emergencies. By combining these components, the proposed method aims to provide comprehensive monitoring and alerts, effectively mitigating risks associated with impaired driving and promoting road safety.

Advantages

- Less complexity
- Low power needed
- Easy to place in remote area.

4. Design Procedure

4.1 Overview of block diagram

Heartbeat Sensor : Heartbeat Sensor is an electronic device that is used to measure the heart rate i.e. speed of the heartbeat. Monitoring body temperature, heart rate and blood pressure are the basic things that we do in order to keep us healthy. In order to measure the body temperature, we use thermometers and a sphygmomanometer to monitor the Arterial Pressure or Blood Pressure.

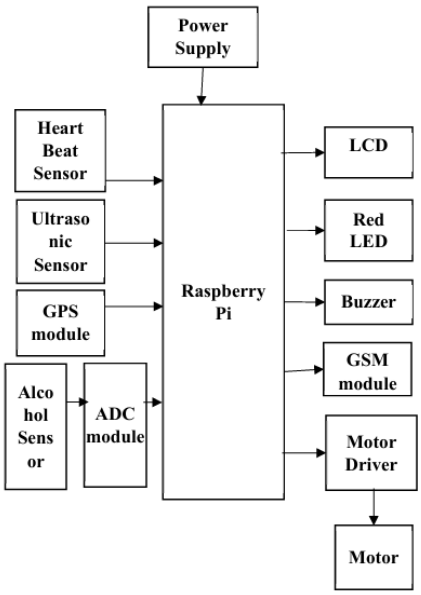

Figure. 3 Block Diagram

Heart Rate can be monitored in two ways: one way is to manually check the pulse either at wrists or neck and the other way is to use a Heartbeat Sensor. Monitoring heart rate is very important for athletes, patients as it determines the condition of the heart (just heart rate). There are many ways to measure heart rate and the most precise one is using an Electrocardiography. But the easier way to monitor the heart rate is to use a Heartbeat Sensor. It comes in different shapes and sizes and allows an instant way to measure the heartbeat. Heartbeat Sensors are available in Wrist Watches (Smart Watches), Smart Phones, chest straps, etc.

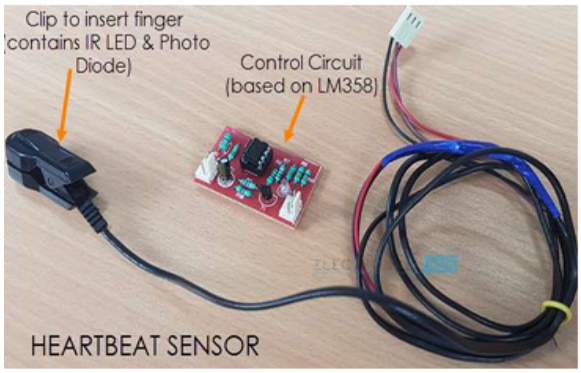

Figure. 4 Heartbeat Sensor Module

Here, the range of concentration for sensing ranges from 300 pm – 10,000 ppm which is appropriate for the detection of a leak.

Figure. 4 MQ4 Alcohol Sensor

When methane gas and detecting elements get in contact with each other then the resistivity of the detecting element will be changed. After that, the change is measured to get the methane gas concentration. The ignition of Methane gas is extremely exothermal which means it generates a huge amount of heat once ignited.

The principle behind the working of the Heartbeat Sensor is photo plethysmograph. According to this principle, the changes in the volume of blood in an organ is measured by the changes in the intensity of the light passing through that organ. Usually, the source of light in a heartbeat sensor would be an IR LED and the detector would be any Photo Detector like a Photo Diode, an LDR (Light Dependent Resistor) or a Photo Transistor. With these two i.e. a light source and a detector, we can arrange them in two ways: A Transmissive Sensor and a Reflective Sensor. In a Transmissive Sensor, the light source and the detector are place facing each other and the finger of the person must be placed in between the transmitter and receiver. Reflective Sensor, on the other hand, has the light source and the detector adjacent to each other and the finger of the person must be placed in front of the sensor. Alcohol Sensor (MQ4) Module The MQ4 methane gas sensor is extremely used for detecting gas leakage at home or in

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industries like Methane (CH4) & CNG Gas. This gas sensor is highly responsive in very little time, so based on the sensitivity requirements; it can be adjusted through a potentiometer. This is an analog output sensor, used like a CNG (compressed natural gas) sensor within the series of MQ sensors. MQ4 methane gas sensor is a MOS (metal oxide semiconductor) type sensor, used to detect the methane gas concentration within the air at either home or industries & generates output like analog voltage by reading it.

5. Results and Discussion

Raspberry Pi is a series of small single-board computers (SBCs) developed in the United Kingdom by the Raspberry Pi Foundation in association with Broadcom. Since 2013, Raspberry Pi devices have been developed and supported by a subsidiary of the Raspberry Pi Foundation, now named Raspberry Pi Ltd. The Raspberry Pi project originally leaned toward the promotion of teaching basic computer science in schools. The original model became more popular than anticipated, selling outside its target market for diverse uses such as robotics, home and industrial automation, and by computer and electronic hobbyists, because of its low cost, modularity, open design, and its adoption of the HDMI and USB standards.

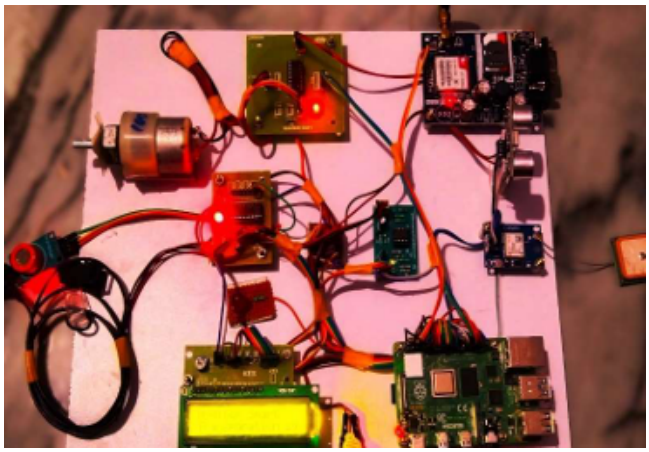

Figure. 5 Working model of Raspberry Pi

The mechanism of Alcohol sensor module ranges is up to 3000 threshold value More than that red led glows and buzzer will buzz and ignition system turns off,

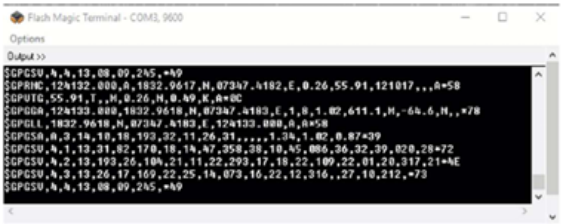

Figure. 6 Output data from GPS receiver module displaying on a serial terminal

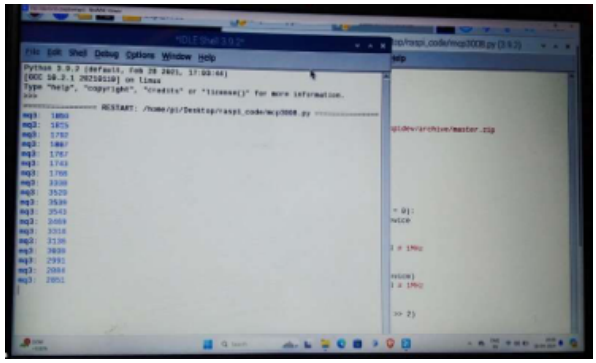

Figure.7 Alcohol Sensor Detection in The Form of Threshold Values

GPS receiver module gives output in standard (National Marine Electronics Association) NMEA string format. It provides output serially on Tx pin with default 9600 Baud rate. This NMEA string output from GPS receiver contains different parameters separated by commas like longitude, latitude, altitude, time etc. Each string starts with '$' and ends with carriage return/line feed sequence

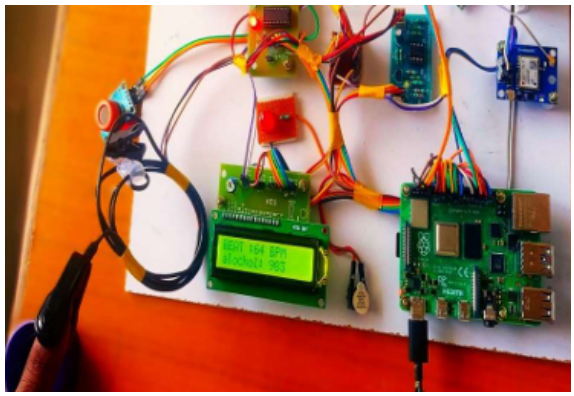

Figure. 8 Heart Beat Sensor Detected Heart Rate in BPM

The mechanism of heart beat sensor module range is up to 100 BPM threshold value More than that red led glows and buzzer will buzz and ignition system turns off.

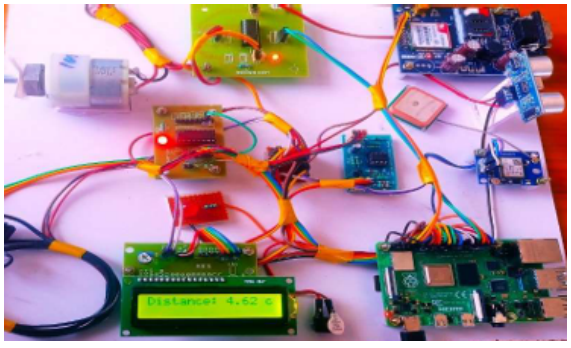

Figure.8 Ultrasonic Sensor Detects the Distance of The Object

The mechanism of ultrasonic sensor module ranges up to 5cm above that buzzer will buzz and red led glows and ignition system dc motor turns off. Heart

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rate will increase more than that of threshold value, The GPS receiver receives latitudes and longitudes from the GPS module. On that time the GPS module is helpful for location tracking.

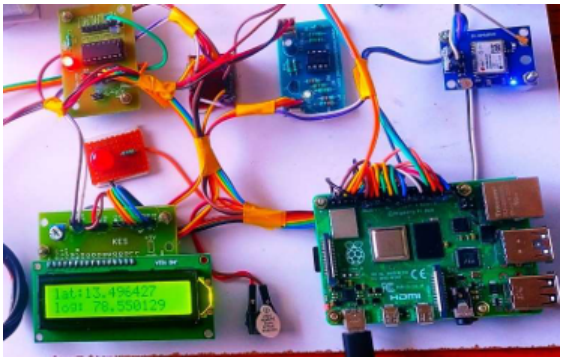

Figure. 9 Latitudes and Longitudes Are Identified Using GPS Receiver.

6. Conclusion and Future Scope

In conclusion, the integration of multiple sensors and modules with a Raspberry Pi presents a promising solution for enhancing vehicle safety. By continuously monitoring the driver's heartbeat, detecting alcohol levels, and measuring distances, the system provides comprehensive monitoring and alerts. This holistic approach addresses the limitations of previous methods by offering early detection of impairment and timely warnings to prevent accidents. Additionally, the inclusion of visual and auditory feedback mechanisms ensures enhanced situational awareness for the driver. With precise tracking capabilities and integration with emergency response systems, the proposed system stands to significantly mitigate risks associated with impaired driving and promote overall road safety.

The development of the smart transportation system using IoT technology for enhanced road safety lays a solid foundation for future advancements and expansions. One potential avenue for further research and development is the integration of advanced machine learning algorithms to analyze the collected data more intelligently. By employing machine learning techniques, the system can learn and adapt to individual driving behaviors, thereby improving the accuracy of risk detection and intervention strategies. Additionally, there is scope for enhancing the system's connectivity and communication capabilities by incorporating emerging technologies such as 5G networks or vehicle-to-vehicle (V2V) communication protocols. This would enable more seamless and efficient sharing of data between vehicles and infrastructure, leading to improved coordination and collaboration in accident prevention efforts. Furthermore, the scalability of the system could be explored to accommodate larger-scale deployments, such as city-wide implementation or integration with existing smart city infrastructure. Overall, the future scope of this project encompasses advancements in data analysis, connectivity, and scalability to further enhance road safety and mitigate the risks associated with impaired driving and health emergencies.

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